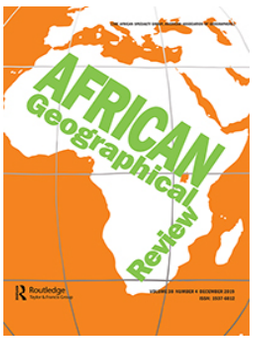

African Geographical Review

ISSN: 1937-6812 (Print) 2163-2642 (Online) Journal homepage: https://www.tandfonline.com/loi/rafg20

Peri-urban transformation and shared natural resources: the case of shea trees depletion and livelihood in Wa municipality, Northwestern Ghana

Frederick Dapilah, Jonas Østergaard Nielsen & Joseph Nyaaba Akongbangre

To cite this article: Frederick Dapilah, Jonas Østergaard Nielsen & Joseph Nyaaba Akongbangre (2019) Peri-urban transformation and shared natural resources: the case of shea trees depletion and livelihood in Wa municipality, Northwestern Ghana, African Geographical Review, 38:4, 374-389, DOI: 10.1080/19376812.2018.1480395

To link to this article: https://doi.org/10.1080/19376812.2018.1480395

© 2018 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group

Published online: 05 Jul 2018.

Submit your article to this journal

Article views: 928

View related articles

View Crossmark data

Citing articles: 2 View citing articles

Full Terms & Conditions of access and use can be found at
https://www.tandfonline.com/action/journalInformation?journalCode=rafg20

AFRICAN GEOGRAPHICAL REVIEW
2019, VOL. 38, NO. 4, 374–389
https://doi.org/10.1080/19376812.2018.1480395

Routledge
Taylor & Francis Group

OPEN ACCESS Check for updates

Peri-urban transformation and shared natural resources: the case of shea trees depletion and livelihood in Wa municipality, Northwestern Ghana

Frederick Dapilah[a], Jonas Østergaard Nielsen[a] and Joseph Nyaaba Akongbangre[b]

[a]IRI-THESys and Geography Department, Humboldt-Universität zu Berlin, Berlin, Germany; [b]Center for Conflict Transformation and Peace Studies, Damango, Ghana

ABSTRACT

This article explores the implication of urban expansion on shared natural resources and livelihoods in peri-urban areas of Wa municipality of Northwestern Ghana using mainly qualitative research methods. The study shows that rapid urban expansion is the main driver of the depletion of shea trees and livelihood transformation of the people living in these hitherto rural areas. Peri-urbanization manifests in many forms including the clearing of shea trees to make way for sand/stone mining and residential housing. The lumbering of shea trees for charcoal making and fuelwood to meet urban energy demands and the breakdown of traditional customary laws and the non-existence of land use plans in these areas are further factors behind the depletion of shea trees. The study concludes that peri-urbanization of Wa and its rural surroundings is not producing the desired transformations in livelihood, but rather poses an enormous challenge for the use and management of shea trees for the population whose livelihoods depend on them. Drawing on these processes and recognition of trade-offs between objectives, uses and users, relevant policy options are recommended.

ARTICLE HISTORY
Received 6 November 2017
Accepted 13 May 2018

KEYWORDS
Peri-urban; sustainable livelihood; Shea trees; shared natural resources; Wa municipality; Northwestern Ghana

1. Introduction

Recent statistics indicate that continuing urbanization and the growth of the world's population is projected to add 2.5 billion people to the urban population by 2050, with nearly 90 percent of the increase concentrated in Asia and Africa (United Nations Department of Economic and Social Affairs/Population Division [UNDESA/PD] 2014). Africa is urbanizing at an alarming and often at unsustainable rate (Satterthwaite, McGranahan, & Tacoli, 2010; United Nations Human Settlement Program [UN-HABITAT], 2014) with official records indicating the growth to reach 58 percent by 2050 (UN-HABITAT, 2013). A major challenge in this regard is the fact that most of the growth experienced in Sub-Saharan Africa (SSA) is taking place in so called peri-urban areas (Barry & Danso, 2014; Doan & Oduro, 2012) and there are signs that this growth is unlikely to turn into opportunity (Cobbinah, Gaisie, & Owusu-Amponsah, 2015; UNDESA/PDA, 2014) without a major effort from researchers and public policy.

CONTACT Frederick Dapilah dapilafr@hu-berlin.de

© 2018 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.
This is an Open Access article distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivatives License (http://creativecommons.org/licenses/by-nc-nd/4.0/), which permits non-commercial re-use, distribution, and reproduction in any medium, provided the original work is properly cited, and is not altered, transformed, or built upon in any way.

Peri-urban areas (PUAs) have been defined as areas where urban and rural features and processes meet, interact and intertwine (Tacoli, 2003). They are usually located between the city and the countryside at the outskirts of an urban area (Cobbinah & Amoako, 2014). As such, peri-urban refers to the fringe of the city but also to a particular spatial context where rural and urban features coexist, in environmental, socioeconomic and in institutional terms (Allen, 2003; Allen, Apsan Frediani, & Wood Hill, 2014). In general, peri-urban transformation has been blamed for most of the ills of African cities ranging from unplanned rapidly increasing settlements, unemployment, informality, poverty and a lack of access to environmental services and other crucial infrastructure (Briggs & Yeboah, 2001; Goodfellow, 2013). In combination, these factors have made urban management a daunting task for city authorities and new ways of thinking about peri-urbanization is increasingly argued (Gandy, 2006; Parnell, Pieterse, & Watson, 2009). The urgency of this task is also linked to the fact that residents in these areas are invariably exposed to tenure security, violence and crime (Potts, 2013). Indeed, Mbiba and Huchzemeyer (2002) have highlighted that the nature of peri-urban transformations in SSA is also characterized by conflicts defined by powers and resources discrepancies between those competing for entitlements to land.

On a more positive note, peri-urban settlements do generate not only housing for the often very poor but also economic opportunities including poultry farming, small and medium scale industries and horticultural investments. Briggs and Mwanfupe (2000) study in Dar es Salaam show for example how the transformation of peri-urban areas there caused a change from 'a zone of survival' to 'a zone for investment', driven by permanent housing and commercial agriculture and horticulture supplying fresh produce to the city. Similarly, Amis (1996) study in Kenya exemplifies how officials and urban elites benefited from the commercialization of informal housing (which accommodates 55% of Nairobi's population on only 5.8% of Nairobi's land area). The character of peri-urban areas is thus many sided, but their rapid growth across the continent presents enormous challenges generally agreed upon (e.g., UN-HABITAT, 2014).

In Ghana, where the study took place, peri-urbanization is widespread and expanding rapidly across the country. It has resulted in massive expansions not only of large cities such as Accra, Kumasi and Tamale (Doan & Oduro, 2012; Ghana Statistical Service, 2012) but also of small cities such as Wa. The effects have been mixed as peri-urbanization seems to present both opportunities and damaging effects on ecosystems and livelihoods in these zones (Kasanga & Kotey, 2001; Kuusaana & Eledi, 2015). While shea trees form an important component of livelihoods in northern Ghana and in West Africa (Fortmann, 1985; Poudyal, 2011; Rousseau, Gautier, & Wardell, 2017) much of the studies on shea trees has concentrated on rural communities with little attention given to it in rapidly urbanizing cities. This study therefore, closes this research gap. It does so by exploring the implication of peri-urban expansion on shared natural resources i.e., shea trees and livelihoods in Wa municipality of Northwestern Ghana.

After the introduction, the next two sections present the setting and the methodology. This is then followed by the results. In the discussion section, we place our results in the natural resource management and sustainable livelihoods literature and argue that in the four study sites, shared natural resources such as shea trees and livelihoods of residents in these hitherto rural areas are vulnerable to peri-urbanization. As such, the paper provides new insights into natural resource management and sustainable livelihood literature in rapidly urbanizing cities in SSA. The paper is rounded off by a conclusion.

2. Wa and its urban fringe

This study was carried out in four (4) peri-urban communities: Guli, Nakore, Kpongu and Sing of Wa Municipality of Upper West Region in northern Ghana (Figure 1).

The socioeconomic condition of this region and northern Ghana in general is attributable to a range of factors including changing climate, policy neglect, political marginalization, poor infrastructure, localized conflict, rapid population growth, low investments, and natural disasters (Dickson,

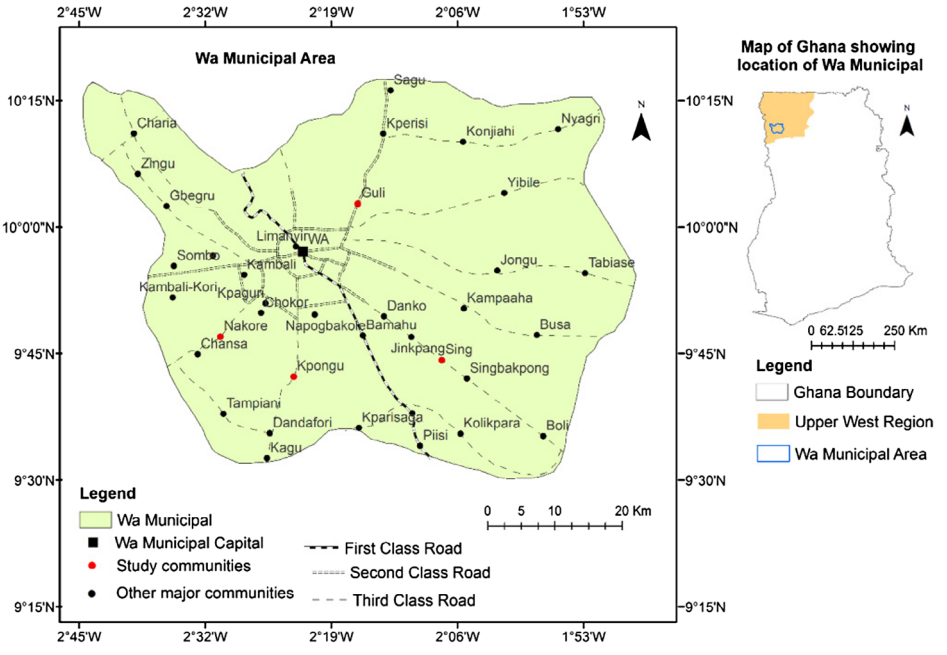

Figure 1. The study context. Source: Authors.

1968; Ghana Statistical Service, 2012; Yaro, 2012). Colonial policy deliberately reserved the erstwhile Northern Territories as a labor reserve for commercial and intensive farming, mainly in cocoa farms in the south with modest attention to infrastructural and socioeconomic development (Dickson, 1968). The neglect of the north by the British colonial administration has mainly been continued by post-colonial governments of Ghana after 1957, which has led to a strong north–south divide concerning poverty rates as well as education, health and transport infrastructure (Ghana Statistical Service, 2012; Yaro, 2012). Official records from the Ghana Statistical Service show that, although only 22 percent of the total Ghanaian population is living in the three northern regions of the country (Northern Region, Upper East Region and Upper West Region), about half of the residents are poor and even 80 percent of the extremely poor are residents of one of the three northern regions (Ghana Statistical Service, 2012).

These factors enumerated are also seen in the four study sites where there is lack of access to basic infrastructure such as drinking water and road networks, low investment opportunities and youth unemployment during the non-agricultural season between November and April.

A major reason behind this situation is, besides the general ones just mentioned, the incorporation of the four study sites into the city of Wa due to urban expansion mainly through peri-urban settlements. Wa has grown from a small town of 13,740 people in 1970 to now being a medium-size city of almost 135,000 residents, including its' peri-urban areas (Ghana Statistical Service, 2012). This phenomenal growth rate has largely been due to a relatively high fertility rate and rural-urban migration. The total fertility rate for Wa is 5.2 as compared with 3.1 for urban Ghana and 4.2 for Ghana as a whole (Ghana Statistical Service, 2014). Only a decade ago, Wa was surrounded by farmlands and dispersed settlements, today Wa is surrounded by residential buildings at various stages of completion with little space for urban agriculture and green fields. Figures 2 and 3 provides a visual summary of urban expansion and change in vegetation cover in Wa between the period 1986 and 2016. The peri-urbanization process has caused a dramatic population increase in the four sites as well as depletion in the vegetation cover over the last three decades. In Kpongu, there is currently around 3,455 people, whereas in Nakori, Sing, Guli the population is 1,633, 1,284 and 709 respectively, representing

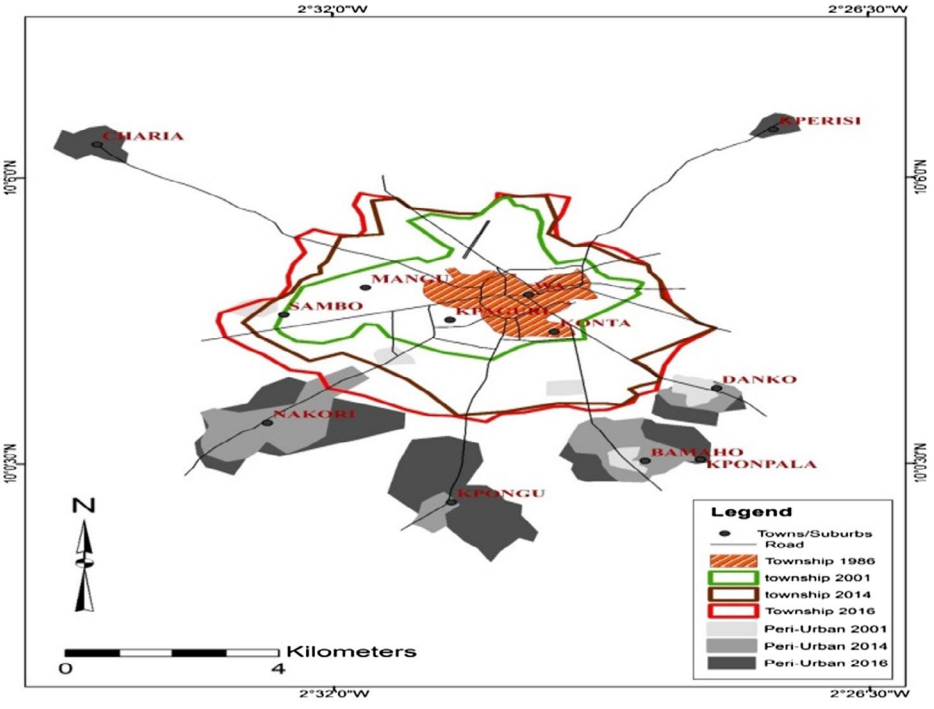

Figure 2. Urban Transition of Wa from 1986 to 2016. Source: Authors.

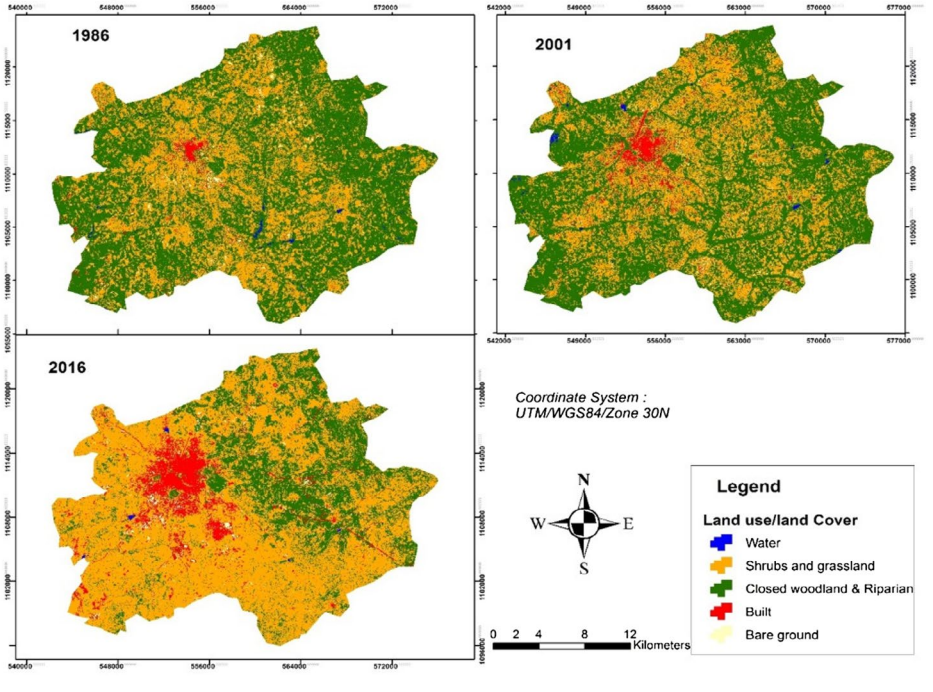

Figure 3. Land Use and Land Cover Change in Wa between 1986 and 2016. Source: Authors.

an increase in the population of the communities by 8–31.5 percent over the past 15 years (Ghana Statistical Service, 2012). In sum, the four study sites have changed from being self-standing villages to being an amalgam of the city as peri-urban areas.

Like in many other recently urbanized areas in Ghana, land rights and entitlements in these communities are still held by customary institutions including chiefs and earth priests (Tindana) (Kasanga, Cochrane, King, & Roth, 1996; Kasanga & Kotey, 2001). Access to and uses of natural resources such as shea trees are governed by traditional authorities in the study communities, mostly chiefs and earth priests (Tindana). As noted by Lentz (2005), in acephalous communities in West Africa, 'first comers' have the right to allocate land and other natural resources including shea to 'late comers' or 'new comers'. In Wa, land ownership is vested in the 'first comers' (earth priest or Tindana) as such, their authority goes beyond only land but all other resources on the land including shea trees. Shea trees unlike other economic trees such as cocoa and cashew are not cultivated. In the whole of northern Ghana and our study sites, shea trees are allowed to grow naturally. Despite attempts by the Cocoa Research Institute of Ghana to develop prototypes of the tree for cultivation, there is still no scientific break-through. Previous research reveals that land and shea tree tenure are distinct but entangled (Elias, 2010; Fortmann & Rocheleau, 1985). However, Fortmann (1995) show that usually, land tenure regimes supersede tree tenure. Shea tree tenure is flexible and dynamic (Rocheleau & Edmunds, 1997) and rights to trees are multiple and overlapping (Fortmann, 1985; Poudyal, 2011). In addition, ownership of certain indigenous fruit trees often belongs to the chief or the original landowners, regardless of their current tenure rights over the land (Boffa 1999; Schreckenberg, 1996). In contrast to the landowners, tenants and borrowers of the land have mostly restricted rights to trees. For example, tenants could harvest non-timber products from economic trees for personal use but not for sale, they could not cut trees growing on the land, plant trees without owners consent, and even where they could plant trees, they generally have to share benefits with the owner (Fortmann, 1985; Poudyal, 2011). It is argued that, customary chiefs now have less authority over shea rules than they have in the past, coupled with a change in access to shea trees and uncertainty surrounding the rules of access to shea products (Rousseau et al., 2017; Wardell, Reenberg, & Tottrup, 2003). For instance, Wardell et al. (2003) note that, the transformation of wooded agricultural landscapes in the Sudano-Sahelian region is the outcome of historically and culturally embedded interactions between complex social, economic and ecological processes which operate at widely varying scales and which change over time. Rousseau et al. (2017) observed that in Burkina-Faso, increasing land pressure, shea prices, and shea trade have increased pressure on shea (Rousseau et al., 2017). For example, they noted that the rules that used to be enforced: the date of the beginning of shea collection, ban on shea collection at night, ban on the collection of unripe shea fruits are no longer respected nor are they tailored to new context of increased competition. Consequently, today, access to forest resources follows a pattern that combines traditional customs and situational adjustment to local politics and power games (Wardell & Lund, 2006).

Environmental factors are also observed to affect the availability of shea trees in the study sites. The savannah ecological-systems are identified to be vulnerable to climate change (Serdeczny et al., 2015). For instance, the annual rainfall in Wa from 1976 to 2016 (Figure 4) shows an erratic pattern over the period, a trend which mirrors in the whole of the West African sub-region.

The analysis of the rainfall data show that, despite the general improvement in recent years, residents that depend on natural resources such as shea trees are still concerned with annual and inter-seasonal fluctuations as it affects shea trees growth and fruit bearing capacity.

Apart from climatic factors, bush burning is an annual ritual practiced by farmers, pastoralist and hunters in the study area and the entire savannah zones. Seasonal bush burning is considered as an important land management practice and is viewed as an important component in maintaining ecosystems balance as it results in fine-grained, patchy mosaic, biodiversity and preservation of unburnt areas (Butz, 2009; Driscoll et al., 2010). It is argued that seasonal burning not only prevents damaging late season fires but also increases biodiversity (Devineau, Fournier, & Savanna, 2010). Humans therefore influence fire regimes in ecosystems by altering the number, location, and timing of ignition across

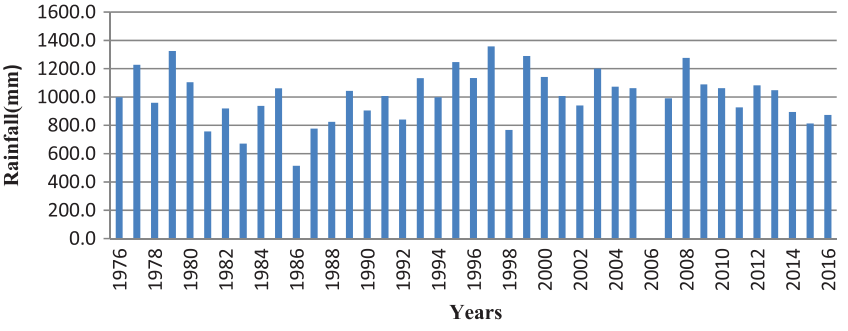

Figure 4. Annual rainfall in Wa, 1976–2016. Source: Adapted from Wa weather station.

temporal and spatial scales (Dube, 2009). On the contrary, fires can have deleterious consequences on common property ecosystem services such as those provided by shea trees (Yaro & Tsikata, 2013; Zida, Sawadogo, Tigabu, Tiveau, & Oden, 2007) especially when set indiscriminately. The impact of the 1983 bushfires in Ghana rendered large tracts of land barren of vegetation and destroying food and crops (Yaro & Tsikata, 2013).

3. Methodology

The study examines the consequence of urban expansion and environmental change on shea tree resource exploitation and livelihoods using qualitative research methods. It was conducted in July–August 2014 and April, 2015. It incorporates three main sources of data collection: semi-structured interviews focus group discussions and transect walks (Creswell, 2003; Sarantakos, 2005). The interviews and focus group discussions revolved around understanding peri-urban processes and how they impact on shea tree resources exploitation and livelihoods of households in the selected communities. This was followed by mapping the institutions and their roles in the governance and management of the shea tree resources.

Participants in the focus group discussions and interviews were purposively selected because they have in-depth knowledge on the topics. In each community, two focus group discussions with sizes of 6–12 people were held. The first focus group discussions included chiefs, elders and opinion leaders. The choice of this group of discussants helped capture the structure of power and access to resources and their exploitation, governance and management at the community level. The second focus group discussion included largely ordinary men and women in the community whose livelihoods depend to some extend on the shea trees. They included farmers, shea nut/ processors and traders, fuel wood traders and charcoal makers.

The focus group discussions were followed by in-depth interviews at the municipal and community level. At the municipal level interviews were conducted with the planning officers at the Wa Municipal Assembly, Officers at the Regional Lands Commission, National Disaster Management Organization (NADMO), Officers at the Regional Environmental Protection Agency (EPA) and Forestry Commission of Ghana. The aim was to elicit information on policy strategies at the municipal level aimed at land use planning and ecosystem services governance and management as well as the effectiveness of these policies. At the community level, thirty-two (32) interviews were held with a segment of the population including chiefs and elders, shea nut/butter processors and traders, charcoal makers and fuel wood traders. The aim was to understand each informant's perspective and therefore was open-ended. Each respondent was asked to: (1) identify the manifestations of environmental change including peri-urbanization in the community (2) their impact on shea resources and livelihoods (trends and forms over the past three decades) and (3) explain institutional structures governing land use and shea tree exploitation and their effectiveness.

Table 1. Socioeconomic characteristics of respondents.

	Sex		Educational Status			Occupation	
Community	Male	Female	Never	Basic	Secondary	Agriculture	Others (trading, quarrying etc.)
Kpongu	3	7	2	4	2	10	10
Guli	2	4	3	3	0	6	2
Nakore	3	7	3	5	2	10	7
Sing	2	4	4	4	0	6	3
Total	10	22	12	16	4	32	23

Source: Field survey, April (2015).

Table 2. Contribution of shea to household income.

Indicator	*N*	Percentage
Very important	21	65.6
Important	7	21.9
Less important	3	9.4
Not important	1	3.1
Total	32	100

Source: Field survey, April (2015).

In addition, transect walks with local residents were undertaken. The residents were identified during the interviews in the communities. They were all males and walked us through the community, and through conversation they narrated the processes of change over the past decade. Different developments such as previous farmlands that have been turned into residential use, areas of thick vegetation that have been degraded, as well as events and challenges and change their communities have experienced over time were covered during these walks. During the research, the first author lived in Wa. All the interviews were conducted in the local language.

4. Results

This section is organized into two sub-sections. The first section describes the socioeconomic and demographic profile of respondents and household dependence on shea trees and livelihoods. This is followed by results on peri-urban transformation and shea trees depletion.

4.1. Socio-demographic characteristics of respondents and shea tree dependent livelihoods

About 68 percent of our respondents were females. Also, a little over one-third of our respondents had no formal education. A majority (62.5%) of them have attained formal education with 50 percent and 12.5 percent having attained basic and secondary education respectively. In terms of occupation, all respondents mentioned agriculture as their major source of income but, about 71 percent of our respondents earned income from other sources such as fuel wood and charcoal sales, sale of labor in the construction industry, sand wining, stone quarrying and shea nut and butter trade (Table 1).

Regarding the latter, an intrinsic link between shea tree resources and household income were reiterated by most of our informants. About two-third of the respondent ranked income from sale of shea products such as shea nut, butter and charcoal/fuel wood trade as very important (Table 2) especially during the off-farm season.

They also explained that income earned from the sale of shea products are used to purchase food, buy farm inputs, payment of school fees and other daily expenses. They further reiterated that income earned from shea is very crucial especially at times when households are in serious economic distress due to no available food from their agricultural production. The few respondents who rated income from shea products as less (9.4 percent) and not important (3.1 percent) argue that they do not rely or

Table 3. Declining household income from shea tree products.

Indicator	*N*
Strongly Agree	23
Agree	7
Disagree	2
Total	32

Source: Field survey, April (2015).

depend on any form of trade in shea resource and therefore they do not derive any form of cash-income from shea resources. These groups of respondent are those who have managed to shift their source of livelihoods away from the agricultural sector. Their livelihood activities are now in trade and services sector, construction industry and other non-farm enterprises in Central Business District of Wa. However, our informants mentioned, due to the reasons treated below, that this crucial source of income is disappearing (Table 3). One man explained, for example, how his household could pick about thirty bags (80 kilos per bag) in the 1980s whereas today, they struggle to pick even five bags. This situation is clearly captured in focus group discussion interviews with our respondents below:

> In the past we could pick enough shea nuts within our immediate environments for processing but now it is impossible because we don't have more shea trees again and the yields too have declined drastically. The processing plant is almost always empty because shea nuts have become scarce and expensive to buy (Respondent 1, 35 years, Nakore)

> Our wives go to the bush and come home with empty basins. So the women have diverted to other activities to earn a living (Respondent 1, 35 years, resident of Sing)

> We the men and the women are all into the quarrying activity. You will see the women tying their clothes very well to prevent them from falling off their waists whiles they engage in the activity. The men too always make sure that their shorts are very tight to be able to crack bigger stones for sale (Respondent 1, 56 years, Kpongu)

Further, our study revealed that households that depended on shea tree resources have become worse-off than thirty (30) years ago mainly due to depletion of shea trees and declining access and rights to use of shea tree resources and changing land tenure mainly due to increasing land sales mostly by landowners ('first comers') and conversion of land in our study sites into other uses such as residential and quarrying fields. Therefore, scarce household income is now spent on essential household items such as cooking oils, pomade and charcoal which hitherto was not part of household daily expenditure since they were easily obtained from shea tree resources.

An elderly woman (Respondent 2, 56 years, Kpongu) narrated that:

> In the past when we used to have plenty shea trees, the fruits served us food for us, we used the butter for coking and soap. When the children came from school they could eat only shea fruit during lunch and they will be okay. But now this is not the case as we have to spend our meager income in buying all these things

Generally, our respondents pointed out that the gradual transformation of household income sources from natural resource based to other income sources such as rent from land sales; sand/stone mining is highly problematic, especially for women and other dependent populations such as children and the elderly. They mentioned for example that it is only the active population that is able to take advantage of these new forms of livelihood activities. Likewise, it is the elites and land owning families that are the beneficiaries of land sales. Beside, residents of these peri-urban areas due to their low level of education are unable to seek new or alternative sources of income in the formal sector.

4.2. Peri-urban transformations and shea trees

Our respondents underscored the rapid transformation of their communities over the past three decades as the major reason behind this development. They observed that there have been significant rapid population increase, new residential buildings, increased sand wining, stone quarrying and deterioration of vegetation cover. Analysis of satellite images between 1986–2016 (Figure 3) in Wa indicate

Table 4. Socioeconomic and environmental impacts on shea trees.

Stressor	Source	Impacts	Respondents reporting
Drought	Climatic	Fruiting	23 (32)
Rainfall variability	Climatic	Fruiting	23 (32)
Wind/rainstorms	Climatic	Fruiting	23 (32)
Sand/Stone winning	Human	Shea tree population	32 (32)
Conversion of lands	Human	Shea tree population	19 (32)
Bushfire	Human	Shea tree population	28 (32)
Lumbering	Human	Shea tree population	32 (32)
Pest and Disease	Biological	Fruiting	12 (32)

Source: Derived from semi-structured interviews and focus group discussions.

a change in land use and land cover over the period. The 1986 image shows a more greener (closed wooded land and riparian) landscape with a small built up area. However, the 2006 and 2016 images show a gradual expansion of the built up area with decreasing vegetation cover. This conforms with findings from our respondents as there was a general consensus among respondents and discussants that over the past three decades, there has been a decline in shea tree population as well as the fruit bearing capacities of the trees due to a mixture of mainly environmental and socioeconomic processes related closely to peri-urbanization. Among these, lumbering for fuelwood, charcoal production, bushfires, sand winning and stone quarrying, environmental impacts related to these and conversion of lands to residential use were considered to be the most detrimental to shea trees (see Table 4).

4.2.1. Fuelwood and charcoal production

Charcoal making and increasing collection and sale of fuel wood to meet urban demands was underscored by the respondents. Regarding fuelwood to meet urban demands, the shea trees is the much preferred choice for fuelwood and charcoal production as it is believed that fire from shea wood last longer and is better for cooking compared to other tree species. Women were found to be the most involved in lumbering of shea for charcoal, as Abu a 54 year old male farmer from Nakore explained:

> Charcoal is gotten from the shea tree. In the past we used to have big shea trees in the community but now you can't see even one. Now if not in your farm you can't get shea nuts to pick (Respondent 2, Nakore)

4.2.2. Bushfires

Bush burning was found to be a common practice in our study communities especially during dry seasons. Different accounts were given by our respondents as to why bush burning is an annual practice in the study sites. A common explanation was that bush burning is good for hunting wildlife/game and for the regrowth of grass for animals including cattle. Bushfires were however also identified as negatively affecting shea population because it takes the trees a very long time to recuperate from fires and in some instances even kill them. The impact of bushfires on the shea trees was, however, nuanced among respondents in the focus group discussions. Some respondents were of the view that, bushfires are vital in the flowering and fruiting of shea trees and as a result it is good practice to allow fire to burn the trees. They argued that, when shea trees are burnt by fires, the following season, they fruit well producing big and sweeter fruits. As a result, they consciously allow the shea trees to be burnt by fires.

4.2.3. Sand and stone mining

The study also found that sand and stone mining, although, not directly related to the use of shea trees per se, have negative consequences on the trees population. The rise in the construction industry to meet the deficit in housing has led to an increase in sand and stone mining activities in the study sites mostly undertaken by firms in Wa with their collaborators in the study communities (see Plate 1) The interviewees mentioned that the construction industry serves as an alternative source of income. Indeed, many young men are employed by contractors to mine sand, while women mainly mine stones. Although, sand and stone mining serves as an alternative income source for households,

Plate 1. Destructive Sand wining. Source: Field survey, April (2015).

there were general agreements that the way and manner they are carried out are detrimental to shea trees resources. This is because one, large tracts of the trees are cleared in the process. Secondly, the removals of top-soils that support the trees expose them to run-offs. Finally, stone and sand mining are carried out in an uncoordinated manner without recourse to land use regulations. Most often, mining concessions agreements between landowners and constructions firms are done at the 'blind-side' of community members in our study sites and also Land administration Authorities at the Wa Municipal Assembly (WMA). The net effect is that access to lands that hitherto provided shea resources to household are lost. Mba, a native of Guli said this on this issue:

> Last year, I went to my farm and noticed that some people are digging sand from my farm, when I confronted them they said the Chief gave them the land and asked them to mine the sand on the plot (Respondent 1, 60 years)

4.2.4. Conversion of lands for residential purposes

They study found that the increasing demand for land for residential uses to meet the growing urban population of Wa is having negative impacts on shea tree population. New land owners tend to use acquired lands without recourse to preserving the trees. In most cases, shea trees are for example cleared to make way for residential facilities. Interviews with Officials of the Survey and Mapping Division of the Land Commission revealed that there are no existing land use plans/schemes for our study sites and as such these hitherto rural fringes, have been allowed to grow and evolve on their own. Customary landowner's were often found to spearhead and finance this processes by way of zoning lands facilitated by the Survey and Mapping Division of the Lands Commission of Ghana. In most cases, these lands are sold without recourse to the current users of the land and the environmental impact of the new land use on for example shea tree species. Interviews with officers of the Building and Inspectorate Department of the Wa Municipal Assembly and Environmental Protection Agency of Ghana revealed that most lands in our study sites have indeed been put to use without building permits and an environmental impact assessment. Below is the response of an officer captured during an interview session:

> In this town, people acquire plots and put up their buildings without a single paper with them. They do not have site plans not alone to talk of building plans. Without these documents, we cannot grant those permits (Officer, Wa Municipal Assembly)

Also, respondents observed that when lands are sold, there is often competition among women to fell the shea trees for charcoal or fuel wood because they lose their usufruct rights to the new land

Table 5. Average loss of farm lands and access to shea tree resources.

Respondents	*N*	Average/loss of land
Men	10	1–3 Acres loss over the past 10 years
Women	22	1–10 Acres loss over the past 10 years

Source: Field survey, April (2015).

owner causing a further depletion of shea tree population. More than half of our respondents who are women reported that on average they have loss between 1 and 10 acres of land that they used to have access to shea tree resources (Table 5).

> We have little say on land issues in this village because land belongs to the men and the family in which you are married to. We did not bring land to our husband's house, so we only pray that the land that has been allocated to us is not sold out (Respondent 3, 41 years, Kpongu)

4.2.5. Environmental impacts

Besides these socioeconomic processes, weather changes were mentioned by respondents to impact the shea trees. The most often mentioned weather phenomena perceived to impact the trees were rainfall, high temperatures, and winds. The respondents agreed that the periods between rainfall and drought have become increasingly erratic and unpredictable over the past three decades. This has negative implications on the growth and fruiting of shea trees and reduced fruits production was often mentioned as a consequence of a changing weather pattern. It was for example narrated by respondents that, when shea trees are flowering and there is rainfall or windstorms, the pollination process is negatively affected because the windstorms and rains shed-off the pollens.

Biological change processes were also found to affect growth as well as the fruit bearing potentials of shea trees. Pests such as locusts and worms destroy the leaves of the shea trees by eating them. Moreover, we were told that pests and worms cause the trees to shed their leaves affecting pollination and the fruit bearing capacity of the shea. Over half of the respondents interviewed indicated that, although it is common for pest to attack shea trees, the number of shea trees attacked has increased over the past three decades.

4.2.6. Land rights and entitlements

Shea trees are held under an open access regime, which is characterized by the absence of formal regulations. Shea trees found on farms and uncultivated lands in the communities are owned by the farmer and the community respectively. Owners of land have the prerogative to exclude or allow others to exploit shea resources on their lands both on cultivated and fallow lands. Shea resources found on cultivated and fallow lands were 'jealously' guarded by their owners compared to those found in communal lands. In most cases, these lands are regarded as 'no man's land' and as a result the exploitation of shea on such lands is done without recourse to their sustainability.

The notion of 'no man's land' was closely related to the diminishing power of the traditional authorities within the communities studied. Although the traditional authorities are the governors of land resources including shea trees, the respondents explained that their roles are diminishing and as a result they are unable to function effectively. The respondents argued that, even those who are to support the traditional authorities, for example, community elders are often found to be the utilizing the resources from shea trees found in common lands according to their own desire.

5. Discussion

Peri-urban areas are relatively favorable for biomass production (food and firewood) (Broekhuis, de Bruijn, and de Jong (2004). Our results confirm this as our research sites are the main sources of fuelwood and sand and stones for construction purposes in urban Wa. The demand for and use of charcoal has been projected to increase in urban areas of SSA (International Energy Agency, 2014)

and in Wa charcoal remains the most readily available source of energy, as well as the most affordable in comparison with other alternative sources, for example electricity (Ghana Statistical Service, 2012). This makes shea trees more vulnerable to lumbering as it is among the most preferred for charcoal production. Sand and stone mining in other cities in Ghana have been identified among human activities that compromise environmental integrity in peri-urban areas (Yankson, 2002). These activities indeed as indicated in our results, strip-off shea trees and expose them to the agents of denudation. Satellite images for land use and land cover change for Wa between 1986 and 2016 confirms a gradual depletion of vegetation cover (see Figure 3).

Across SSA, a large number of residents within these areas depend to some extend on food and income generated from natural resources (Tacoli, 2003; Twyman & Slater, 2005). For food security, it has been similarly argued that natural resources are essential for peri-urban livelihoods (Appiah, Schroder, Forkuo, & Bugri, 2015; FAO, 2009). In our four study sites a similar situation was found. There, both men and women engaged in livelihood activities such as fuelwood sales, charcoal production, stone and sand mining all of which at the same time are detrimental to shea tree population. Alternative livelihood strategies such as sand/stone mining were thus found to harm the trees for example through removal of the top-soil that support them. Other detrimental impacts included changing weather patterns and other socioeconomic processes such as land rights and entitlements and a lack of land use plans. These show that managing natural resources for the benefit of people living in these areas is a complicated matter. Indeed, previous studies (e.g., Lovet & Haq, 2000) show that, even when there is selective preservation of these valuable trees, socioeconomic and environmental processes such as those described in this paper have decreased the overall number of shea trees.

Considering gender, Okiror, Agea, Okia, and Okullo (2012), found that, male household heads were more willing (51 percent) to manage shea trees than their female counterparts. In contrast to our findings, we found men to be indifferent whereas women were found to be the ones largely responsible for shea tree lumbering for charcoal making and fuelwood trade because their income were largely dependent upon resources from shea trees. The study also found that when women lose access and entitlements to parcels of land through land sales, they try to compensate for their deprivation through lumbering of shea trees on the plot for charcoal and fuelwood. Kasanga and Kotey (2001) found something similar in their empirical work in peri-urban Ghana showing that women bear the brunt of land sales as they are increasingly becoming landless. But the strong emphasis in our findings which sets it apart from previous studies is on the mechanisms which regulate land use, access and management of an important resource such as shea tree, something which is rarely discussed in the literature on peri-urban transformation in Ghana. Past studies in peri-urban areas have largely concentrated on tenure security and land management (Barry & Danso, 2014; Gough & Yankson, 2000; Kasanga and Kotey, 2001), urbanization and agricultural production (Allen, Apsan Frediani, & Wood Hill, 2014; Kuusaana & Eledi, 2015; McGregor, Adam-Bradford, Thompson, & Simon, 2011) and urban land use planning (Boamah, Gyimah, & Bediako, 2012; Cobbinah and Amoako, 2014). This study therefore closes this gap by showing how peri-urbanization, land tenure and security and those whose livelihoods depend on shea trees are interwoven as such advancing new knowledge for managing natural resources and sustainable livelihoods in rapidly urbanizing cities.

Our findings further exemplifies that, one of the greatest challenges for the sustainable exploitation of shea resources is the varied and uncoordinated interest of users. As our results show, the traditional institutions lack the capacity to manage shea trees, accompanied by a lack of land use plans by the legally mandated institutions such as the Lands Commission of Ghana makes the management of natural resources difficult. Arko-Adjei (2011) study in Ghana illustrates that existing customary systems in peri-urban areas may not be able to evolve to the extent that they can cope with the speed, volume, diversity and complexity of contemporary land management issues. Insights from Boamah et al. (2012) study in Wa point to the fact that most planning authorities are battling with persistent human resource, financial and logistical challenges as well as legislative conflicts. As a result, uncontrolled peri-urban developments are having a negative toll on shea trees and the livelihoods options associated with them, a situation not helped by climate change related threats including those mentioned

by our informants such as rainfall deficits, high temperature stress, extreme events, pest and disease pressure, and enhanced land degradation (Owusu & Waylen, 2009).

Finally, our results show that peri-urban transformation has negative repercussions on the livelihoods of especially ethnic minorities (non-land owning clans and tribes), women and mostly the elderly who are unable to cope adjust to new forms of urban land use and the emerging livelihood forms in peri-urban Wa. This aligns closely with earlier research on peri-urbanization in Ghana and Sub-Saharan Africa in general (Kasanga & Kotey, 2001; Tacoli, 2003; Twyman & Slater, 2005). In sum, the discussions on the importance of shea trees and sustainable livelihoods of rapidly urbanizing cities, particularly in northern Ghana therefore seem relevant. It serves as source of food (fruits and shea-butter) and a ready source of cash for most households because it is an important export commodity (Poudyal, 2011; Rousseau et al., 2017). Access to and use of shea tree resources are embedded in land rights and tenure (Rousseau et al., 2017; Wardell et al., 2003). As such this paper fills in a huge gap in the literature on shea trees and livehoods by providing a detail account from an urban perspective which has received little attention by previous research (Lovet & Haq, 2000; Okiror et al., 2012; Wardell et al., 2003). It does so by succinctly teasing out the gamut of interwoven factors that negatively impact on shea trees and the livelihood of residents who depend on this important resource.

To counter these developments, as Allen (2003) aptly observed, the problem of institutional fragmentation is relevant for understanding the constraints faced in environmental planning and management within peri-urban areas. The Wa Municipal Assembly (WMA) should address this problem by adopting a broad governance approach. This should include a concerted effort by stakeholders spanning the field of Municipal Planning and Development Office, Lands Commission of Ghana, Forestry Commission of Ghana, Environmental Protection Agency (EPA) and Ministry of Food and Agriculture (MoFA), Ghana and peri-urban communities.

Most beneficial would be the development of a municipal environmental plan that makes way for the creation of green fields for natural resources such as the shea trees and backed by law containing guidelines on their exploitation. The policy guidelines should fit with the local resource use and needs of those who depend on shea trees for their livelihood. Thus, it needs to take into account the appropriate spatial and temporal scales as well as the type of interactions that occur on the ground. As opined by Wandl and Magoni (2017), the challenge of planning the future sustainable development of peri-urban areas is principally to overcome the separation of rural and urban planning and the separation of functions to achieve multifunctionality. Elsewhere, Magoni (2016) has shown how food production with environmental and landscape planning has been brought together through an innovative and integrated planning process to achieve sustainable development.

Besides the issue of integrated planning of peri-urban areas, Narain (2009) and Douglas (2006) have all emphasize the need to revisit top-down approaches to peri-urban planning with peri-urban dwellers being part of policy formulation process by creating multi-stakeholder platforms that bring them into face to face contacts with planning authorities thereby reducing conflicts. On this backdrop, the WMA should design a policy that considers multiple tiers of arenas that can engage in rapid discovery of conflicts among competing land uses in peri-urban Wa and effective conflict resolution. In all, communities should be at the centerpiece in the implementation of these guidelines and supported with institutional infrastructure to aid effective monitoring of users of peri-urban lands.

Further, we support the suggestions of Kuusaana and Eledi (2015) and Boamah et al. (2012) that the Wa Municipal Assembly should incorporate the use of GIS mapping system and commit resources (human, financial, logistics) to land use planning to ensure that comprehensive land use plans are drawn detailing land use zones for effective monitoring of land use developments in peri-urban Wa.

To sum up, the overall goal of the governance approach should aim at protecting shea tree resources so that their availability are not compromised as rules, regulations and norms are instituted in peri-urban Wa. As is clear, a central premise in these suggestions is that they do not include the solving of the real issue namely land rights. In Ghana, as well as elsewhere, this is a very complicated issue and solving it will not be done in time to save the few remaining shea trees in peri-urban Wa. Hence we need intermediary solutions and we need them soon, otherwise residents in these areas loose a

crucial source of household income. It is in this light the findings and recommendation presented in this paper must be seen.

6. Conclusion

The study explored the implication of urban expansion on shea tree resource livelihoods in four study sites in peri-urban Wa. The results showed that, socioeconomic and environmental factors closely related to urban expansion, lack of formal laws on shea tree exploitation and the non-existence of land use plans have coalesced for an unsustainable exploitation of shea trees in this area. Currently, there are far fewer shea trees today than some three decade ago in peri-urban Wa. In sum the continue supply of shea tree resources as an alternative source of livelihoods in the peri-urban areas surrounding Wa looks bleak. The loss of natural resources as a source of income, food supply, and energy source is as elsewhere in SSA worrisome.

Disclosure statement

No potential conflict of interest was reported by the authors.

Notes on contributors

Frederick Dapilah is a lecturer at University for Development Studies, Ghana. He is also a Doctoral Researcher and PhD candidate at IRI-THESys and Geography Department at Humboldt University, Berlin. He holds a Master of Philosophy in Geography and Resource Development from University of Ghana. His current research interest straddles urban-rural transformations and interdisciplinary research. His key interest is in social resilience in Climate Change Adaptation and also urban expansion in Sub-Saharan Africa.

Jonas Ostergaard Nielsen is a professor and a research group leader at IRI-THESys and Geography Department at Humboldt University, Berlin. Jonas' research is concerned with human dimensions of global climate change, land-use change and how these issues open up for explorations around global-local interactions in an increasing connected world. Another central theme throughout his work is causality and how to understand the impact of different global drivers on local lives, and vice versa.

Joseph Nyaaba Akongbangre is a geographic information specialist at the Center for Conflict Transformation and Peace Studies, Damango, Ghana. He Holds a Master of Philosophy in Environment and Resources Management from the University for Development Studies, Ghana. Joseph's current research boarder on urban transformation and the application of participatory Geographical Information Systems in environmental resource management.

References

Allen, A. (2003). Environmental planning and management of the peri-urban interface: Perspectives on an emerging field. *Environment and Urbanization, 15*(1), 135–148. doi:10.1177/095624780301500103

Allen, A., Apsan Frediani, A., & Wood Hill, M. (2014). Land and planning for urban agriculture in Accra: Sustained urban agriculture or sustainable urbanisation? *Irrigated Urban Vegetable Production in Ghana: Characteristics, Benefits and Risk Mitigation,* 161–179. Retrieved from http://www.iwmi.cgiar.org/Publications/Books/PDF/irrigated_urban_vegetable_production_in_ghana-chapter-13.pdf

Amis, P. (1996). Long-run trends in Nairobi's informal housing market. *Third World Planning Review, 18*(3), 271–285.

Appiah, D. O., Schroder, D., Forkuo, E. K., & Bugri, J. T. (2015). Application of geo-information techniques in land use and land cover change analysis in a peri-urban district of Ghana. *ISPRS International Journal of Geo-Information, 4*(3), 1265–1289. doi:10.3390/ijgi4031265

Arko-Adjei, A. (2011). *Adapting land administration to the institutional framework of customary tenure: The case of peri-urban Ghana*. Retrieved from https://doi.org/978-1-60750-746-8

Barry, M., & Danso, E. K. (2014). Tenure security, land registration and customary tenure in a peri-urban Accra community. *Land Use Policy, 39*, 358–365. doi:10.1016/j.landusepol.2014.01.017

Boamah, N. A., Gyimah, C., & Bediako, J. K. N. (2012). Challenges to enforcement of development controls in the Wa municipality. *Habitat International, 36*, 136–142.

Boffa, J. M. (1999). *Agroforestry parklands in Sub-Saharan Africa*. FAO conservation guidelines 34. Food and Agricultural Organization of the United Nations. Rome.

Briggs, J., & Mwanfupe, D. (2000). Peri-urban development in the era of structural adjustment in Africa. The city of Dar es Salaam, Tanzania. *Urban Studies, 37*(4), 797–809.
Briggs, J., & Yeboah, I. E. A. (2001). Structural adjustment and the contemporary sub-Saharan African city. *Area, 33*, 18–26. doi:10.1111/1475-4762.00004
Broekhuis, A., de Bruijn, A., & de Jong, A. (2004). Urban–rural linkages and climatic variability. In A. J. Dietz, R. Ruben, & A. Verhagen (Eds.), *The impact of climate change on drylands: With a focus on West-Africa* (pp. 301–321). Netherlands: Kluwer Academic Publishers.
Butz, R. J. (2009). Traditional fire management: Historical fire regimes and land use change in pastoral East Africa. *International Journal of Wildland Fire, 18*, 442–450.
Cobbinah, P. B., & Amoako, C. (2014). Urban sprawl and the loss of peri-urban land in Kumasi, Ghana. *International Journal of Social, Behavioral, Educational, Economic, Business and industrial Engineering, 8*(1).
Cobbinah, P. B., Gaisie, E., & Owusu-Amponsah, L. (2015). Peri-urban morphology and indigenous livelihoods in Ghana. *Habitat International, 50*(2015), 120–129.
Creswell, J. W. (2003). *Reseearch design: Qualitative, quantitative, and mixed methods approaches* (3rd ed.). London: Sage.
Devineau, J., Fournier, A., & Savanna, S. N. (2010). Fire regimes assessment with MODIS fire data: Their relationships to land cover and plant species distribution in western Burkina Faso (WestAfrica). *Journal of Arid Environments, 74*, 1092–1101.
Dickson, K. B. (1968). Background to the problem of economic development in northern Ghana. *Annals of the Association of American Geographers, 58*(4), 686–696.
Doan, P., & Oduro, C. Y. (2012). Patterns of population growth in peri-urban Accra, Ghana. *International Journal of Urban and Regional Research, 36*(6), 1306–1325. doi:10.1111/j.1468-2427.2011.01075.x
Douglas, I. (2006). Peri-urban ecosystems and societies: Transitional zones and contrasting values. In D. McGregor, D. Simon, & D. Thompson (Eds.), *The peri-urban interface: Approaches to sustainable natural and human resource use* (pp. 18–29). London: Earthscan.
Driscoll, D. A., Lindenmayer, D. B., Bennett, A. F., Bode, M., Bradstock, R. A., Cary, G. J., … Gill, M. (2010). Fire management for biodiversity conservation: Key research questions and our capacity to answer them. *Biological Conservation, 143*(9), 1928–1939.
Dube, O. P. (2009). Linking fire and climate: Interactions with land use, vegetation, and soil. *Current Opinion in Environmental Sustainability*.
Elias, M. (2010). *Transforming nature's subsidy: Global markets, Burkinabè women and African shea butter*. Montréal: McGill University.
FAO. (2009). Food security and agricultural mitigation in developing countries: Options for capturing synergies. *Food and Agriculture Organization of the United Nations*, 82. Retrieved from http://www.fao.org/docrep/012/i1318e/i1318e00.pdf
Fortmann, L. (1985). The tree tenure factor in agroforestry with particular reference to Africa. *Agroforestry Systems, 2*(4), 229–251.
Fortmann, L. (1995). Talking claims: Discursive strategies in contesting property. *World Development, 23*(6), 1053–1063.
Fortmann, L., & Rocheleau, D. (1985). Women and agroforestry: Four myths and three case studies. *Agroforestry Systems, 2*(4), 253–272.
Gandy, M. (2006). Planning, anti-planning and the infrastructure crisis facing metropolitan Lagos. *Urban Studies, 43*(2), 371–396.
Ghana Statistical Service. (2012). 2010 Population and Housing Census. *Ghana Statistical Service,* 1–117. doi:10.1371/journal.pone.0104053
Ghana Statistical Service. (2014). *Ghana Demographic and Health Survey*. Ghana: Accra.
Goodfellow, T. (2013). Planning and development regulation amid rapid urban growth. *Explaining divergent trajectories in Africa. Geoforum, 48*, 83–89.
Gough, K. V., & Yankson, P. W. K. (2000). Land markets in african cities: The case of peri-urban Accra, Ghana. *Urban Studies, 37*(13), 2485–2500. doi:10.1080/00420980020005433
International Energy Agency. (2014). *Africa energy outlook. A foucus on energy prospects in Sub-sharan africa. World energy outlook special report*.
Kasanga, R. K., Cochrane, J., King, R., & Roth, M. (1996). Land markets and legal contradictions in the peri-urban area of Accra: Informat interviews and secondary data investigation. *Research Paper 127*, Land Tenure Center University of Wisconsin-Madison, USA.
Kasanga, K., & Kotey, N. A. (2001). Land management in Ghana. *Russell: The Journal Of The Bertrand Russell Archives,* (February), 42. Retrieved from http://www.eldis.org/vfile/upload/1/document/0708/DOC5021.pdf
Kuusaana, E. D., & Eledi, J. A. (2015). As the city grows, where do the farmers go? Understanding Peri-urbanization and food systems in Ghana - Evidence from the Tamale Metropolis. *Urban Forum, 26*(4), 443–465. doi:10.1007/s12132-015-9260-x
Lentz, C. (2005). First-comers and late-comers: The role of narratives in land claims. In S. Evers, M. Spierenburg, & H. Wels (Eds.), *Competing jurisdictions: Settling land claims in Africa* (pp. 157–180). Leiden: Brill.

Lovet, P. N., & Haq, N. (2000). Evidence for Anthropogenic selection of the sheanut tree (Vitellaria paradoxa). *Agroforestry Systems, 48*(3), 273–288.
Magoni, M. (2016). Energy systems and water and food nexus. In A. Colucci, M. Magoni, & S. Menoni (Eds.), *Peri-urban areas and food-energy-water nexus* (pp. 125–129). Switzerland: Springer International Publishing AG.
Mbiba, B., & Huchzemeyer, M. (2002). Contentious deevlopment: Peri-urban studies in Sub-Saharan Africa. *Progress in Development Studies, 2*(2), 113–131.
McGregor, D. F. M., Adam-Bradford, A., Thompson, D. A., & Simon, D. (2011). Resource management and agriculture in the periurban interface of Kumasi, Ghana: Problems and prospects. *Singapore Journal of Tropical Geography, 32*(3), 382–398. doi:10.1111/j.1467-9493.2011.00438.x
Narain, V. (2009). Growing city, shrinking hinterland: Land acquisition, transition and conflict in peri-urban Gurgaon, India. *Environment and Urbanisation, 21*(2), 501–512.
Okiror, P., Agea, J. G., Okia, C. A., & Okullo, J. B. L. (2012). On-farm management of *Vitellaria paradoxa* C. F. Gaertn in Amuria District, Eastern Uganda. *International Journal of Forestry Research, 2012*, 8.
Owusu, K., & Waylen, P. (2009). Trends in spatio-temporal variability in annual rainfall in Ghana (195-2000). *Weather, 64*(5).
Parnell, S., Pieterse, W., & Watson, V. (2009). Planning for cities in the global south: An African research agenda for sustainable human settlements. *Progress in Planning, 72*, 233–241.
Potts, D. (2013). *Urban livelihoods and urbanization trends in Africa: Winners and losers?*, Paper#57, 1–30. Retrieved from http://www.kcl.ac.uk/sspp/departments/geography/research/epd/workingpapers.aspx
Poudyal, M. (2011). Chiefs and trees: Tenures and incentives in the management and use of two multipurpose trees in Agroforestry Parklands in Northern Ghana. *Society & Natural Resources, 24*(10), 1063–1077.
Rocheleau, D., & Edmunds, D. (1997). Women, men and trees: Gender, power and property in forest and agrarian landscapes. *World Development, 25*(8), 1351–1371.
Rousseau, K., Gautier, D., & Wardell, D. A. (2017). Renegotiating access to shea trees in Burkina Faso: Challenging power relations associated with demographic shifts and globalized trade. *Journal of Agrarian Change, 17*(3), 497–517.
Sarantakos, S. (2005). *Social research* (3rd ed.). New York, NY: Palgrave Macmillan.
Satterthwaite, D., McGranahan, G., & Tacoli, C. (2010). Urbanization and its implications for food and farming. *Biological Sciences, 365*(1554), 1–228. doi:10.1098/rstb.2010.0143
Schreckenberg, K. (1996). *Forests, fields and markets: A study of indigenous tree products in the woody savannas of the bassila region*. Benin: School of Oriental and African Studies, University of London, UK.
Serdeczny, O., Adams, S., Baarsch, F., Coumou, D., Robinson, A., Hare, W., … Reinhardt, J. (2015). Climate change impacts in Sub-Saharan Africa: From physical changes to their social repercussions *Reg Environ. Change, 17*, 1585–1600.
Tacoli, C. (2003). The links between urban and rural development. *Environment and Urbanization, 15*(1), 3–12. doi:10.1630/095624703101286376
Twyman, C., & Slater, R. (2005). Hidden livlihoods? Natural resource-dependent livelihoods and urban policy. *Progress in Develoment Studies, 5*(1), 1–15.
UNDESA/PDA. (2014). *World urbanisation prospects: The 2014 revision highlights*. New York, NY: United Nations.
UN-HABITAT. (2013). *State of the world cities 2012/2013 prosperity of cities, USA and Canada*. London: Routledge.
UN-HABITAT. (2014). *State of African cities(2014) Re-imagining sustainable urban transitions*. London: Routledge.
Wandl, A., & Magoni, M (2017). Sustainable planning of peri-urban areas: Introduction to special issue. *Planning, Practice & Research, 32*(1), 1–3.
Wardell, D. A., & Lund, C. (2006). Governing access to forests in northern Ghana: Micro-politics and the rents of non-enforcement. *World Development, 34*(11), 1887–1906.
Wardell, D. A., Reenberg, A., & Tottrup, C. (2003). *Historical footprints in contemporary land use systems: Forest cover changes in savannah woodlands in the Sudano-Sahelian zone Global environmental change, 13*(2003), 235–254.
Yankson, P. W. K. (2002). Houses and residential neighborhoods as work places in urban areas: The case of selected low-income residential areas in Greater Accra Metropolitan Area (GAMA). *Ghana. Singapore Journal of Tropical Geography, 21*(2), 200–214.
Yaro, J. A. (2012). Re-inventing traditional land tenure in the era of land commoditization: Some consequences in periurban northern ghana. *Geografiska Annaler, Series B: Human Geography, 94*(4), 351–368. doi:10.1111/geob.12003
Yaro, J. A., & Tsikata, D. (2013). Savannah fires and local resistance to transnational land deals: The case of organic mango farming in Dapale, northern Ghana. *African Geographical Review, 32*(1), 72–87. doi:10.1080/19376812.2012.759013
Zida, D., Sawadogo, L., Tigabu, M., Tiveau, D., & Oden, P. C. (2007). Dynamics of sapling population in savanna woodlands of Burkina Faso subjected to grazing, early fire and selective tree cutting for a decade. *Forest Ecology and Management, 243*, 102–115.